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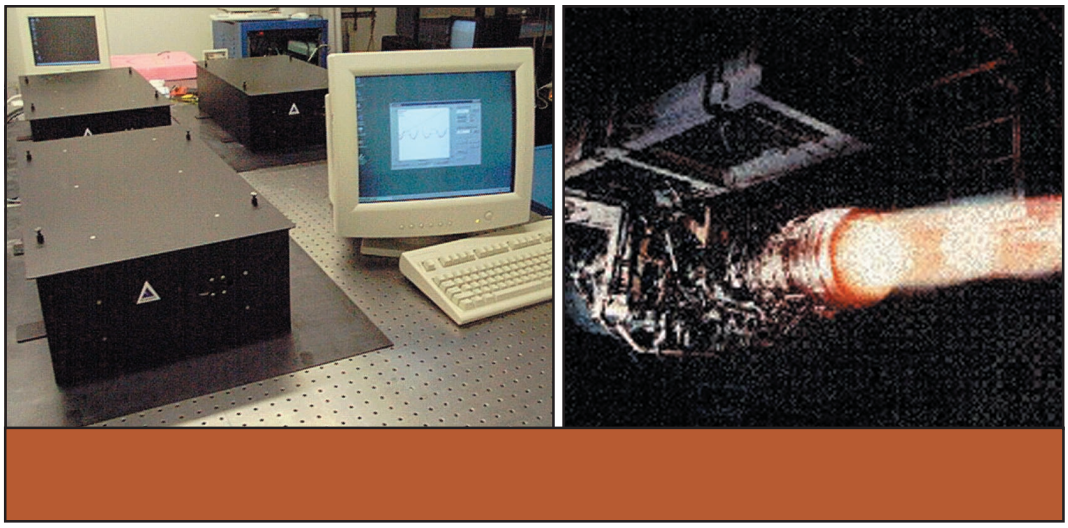
Science and Technology for Tomorrow's Aerospace Forces

Success Story

LASER SOURCE ENABLES SENSITIVE GAS CONCENTRATION MEASUREMENTS FOR AIRCRAFT ENGINE COMBUSTION TESTS



Diode-pumped optical parametric oscillators provide a compact, tunable, room-temperature, mid-infrared light source, which is useable as the basis of a multi-species gas sensor for Air Force combustion diagnostics. These oscillators may improve engine efficiencies through studies using such a sensor, and engineers may use similar techniques for pollution/ industrial process monitoring and electro-optical targeting sensors.

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Accomplishment

Funded by a Phase II Small Business Innovation Research award from the Sensors Directorate, Aculight Corporation in Bothell, Washington, incorporated customer feedback from the Propulsion Directorate and developed a novel, room-temperature, mid-infrared laser source for combustion diagnostics applications. Aculight engineers demonstrated prototype computer-controlled sources operating at four different wavelength ranges from 2.2 to 3.7 microns.

Aculight delivered the prototypes to the Propulsion Directorate for test and assessment in combustion diagnostics experiments. They also supplied similar sources to a commercial company and to the National Institute of Science and Technology for tests in highly sensitive, cavity ringdown species measurements. The world's foremost laser conference hosted a presentation of this groundbreaking work as a post-deadline paper.

Background

The infrared spectroscopy source is a periodically poled lithium niobate (PPLN)-based optical parametric oscillator pumped directly by a near-infrared semiconductor laser. This PPLN-based source produces narrowband (5 MHz) radiation in the 1 to 4 microns wavelength range.

This wavelength range, where absorption features exist for many species of great interest in combustion science and trace species measurement, previously required semiconductor lasers cooled by liquid nitrogen. By contrast, this new source retains the attractive features (compactness, tunability, and robustness) of the semiconductor laser while operating entirely at room temperature and above.

Sensors
Emerging Technologies

Additional information

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